NOAA's Integrative Mapping, Monitoring & Assessment to Define the Status of US Coral Reef Ecosystems

NOAA/NOS
National Centers for Coastal Ocean Science

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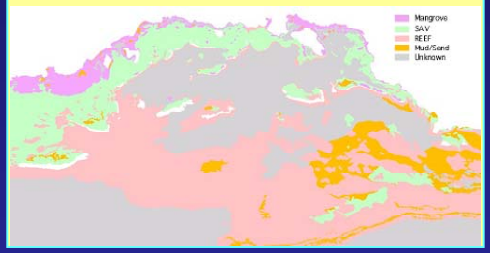
Integrative Mapping, Monitoring & Assessment

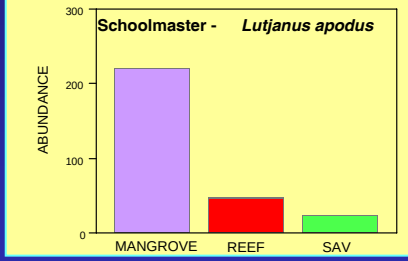
Benthic Habitat Map



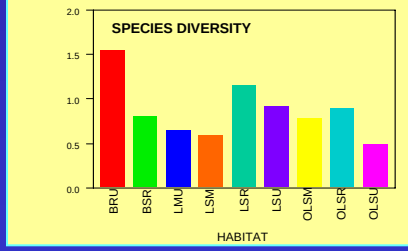
Random Stratified Sampling

Organism Census by Habitat Type

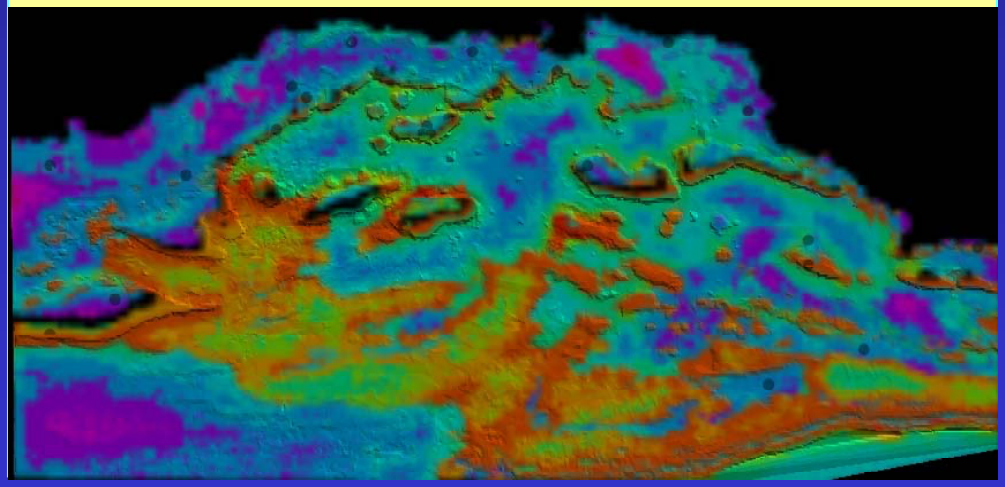
Species Analyses



Community Analyses

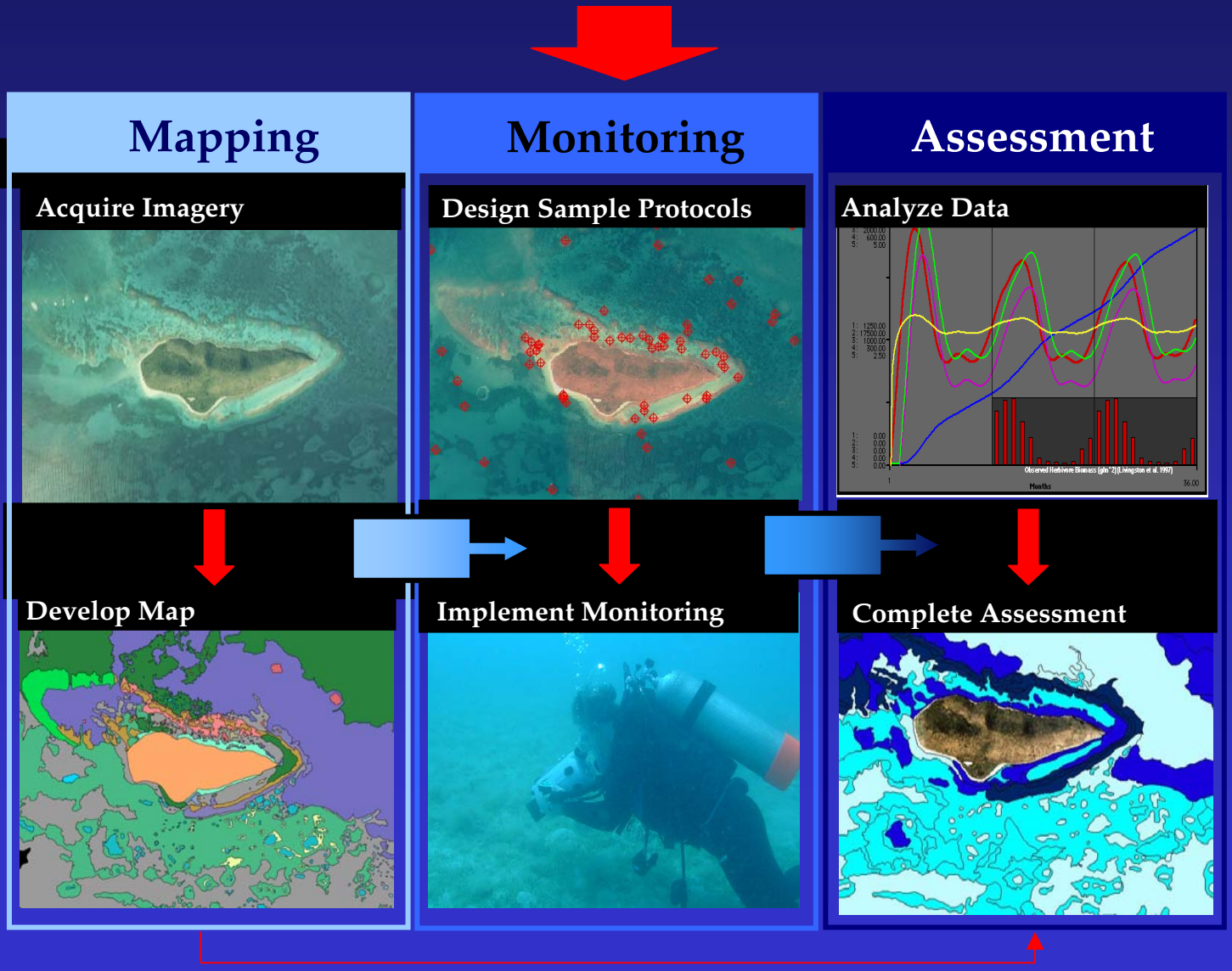


Biological Relevant Boundaries of MPA's and EFH



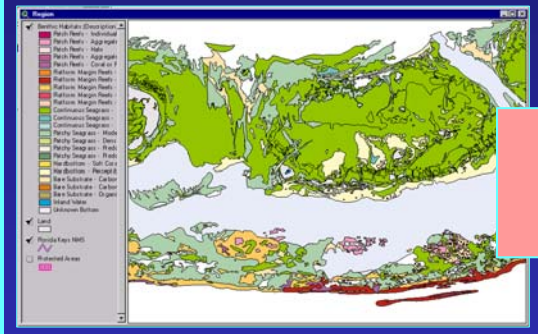
Integrative Mapping, Monitoring & Assessment

National Coral Reef Ecosystem Assessment Process



A Strategy to Map US Coral Reef Ecosystems

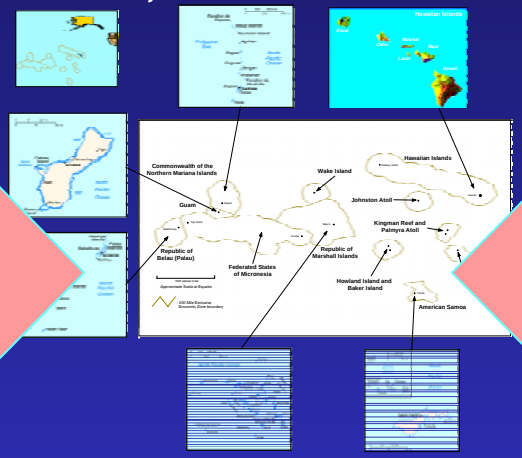
The Mapping Model: Florida Keys Corals, 1992-1998



Aerial photography
Unclassified images
Classified images
Digital Maps

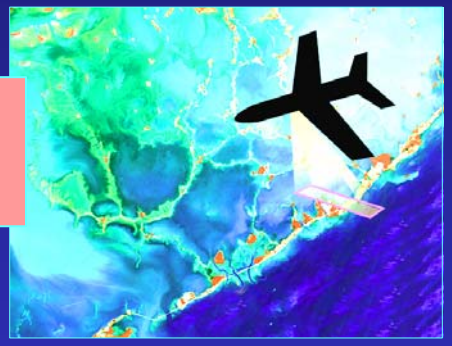
Information transfer:
- Website
- CD-ROM Product
- 11″ x 17″ Atlas Product

The Challenge: Mapping Pacific Corals, 1999-2009



Pacific Coral Reef Study Area:
- Main Hawaiian Islands
- Northwest Hawaiian Islands
- Guam
- American Samoa
- Northern Mariana Islands
- FAS

Improved Mapping Capabilities: Puerto Rico and U.S. Virgin Islands, 1998-2000



Aerial Photography and Hyperspectral Imaging for Habitat Classification

Transferable Methods:
- Classification Scheme

Digital Imagery
Classified Digital Maps
Methods Manual

NOAA/NOS

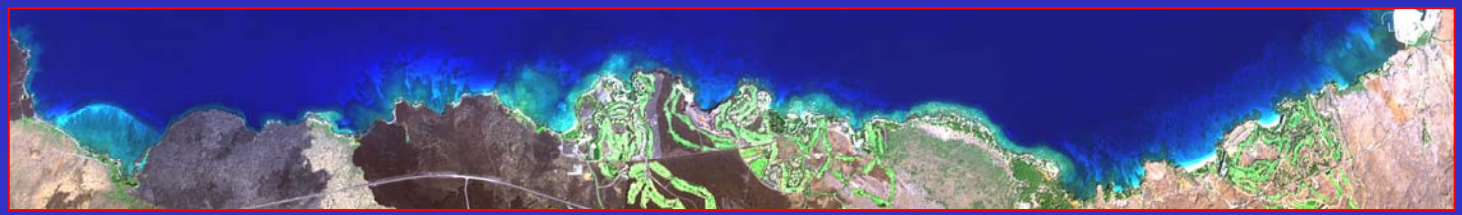
http://biogeo.nos.noaa.gov

Comparison of Remote Sensing Technologies

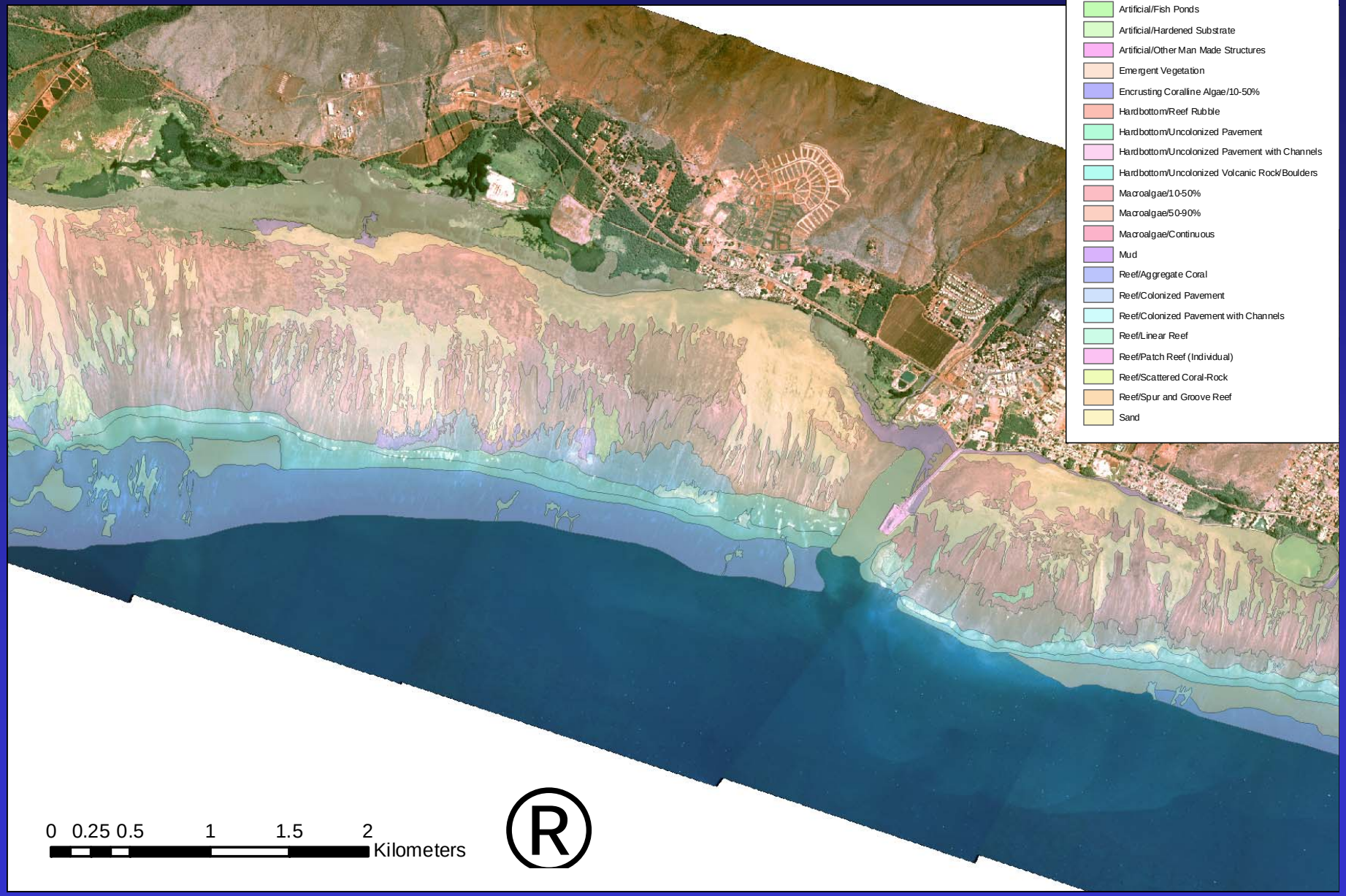
IKONOS – true-color; 4 m pixel

AERIAL PHOTOGRAPHY – true-color; 1.2 m pixel

HYPERSPECTRAL – 72 bands between 350 and 1000 nm; 3 m pixel

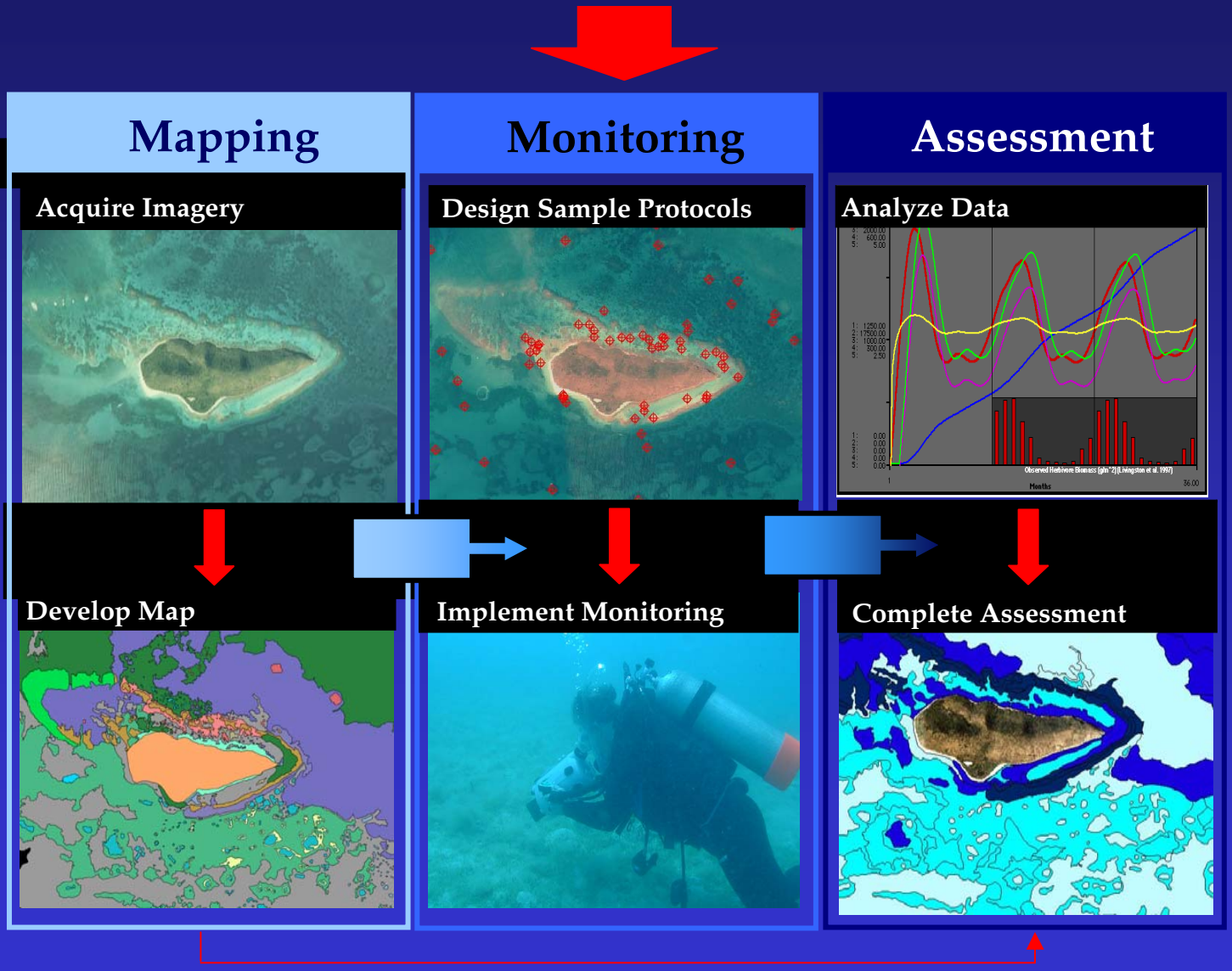


Molokai, Hawaii Coral Reef Ecosystem Habitats



Integrative Mapping, Monitoring & Assessment

National Coral Reef Ecosystem Assessment Process



National Coral Reef Ecosystem Monitoring Program

Cooperative Monitoring Studies - Meeting Local Management Needs & National Program Requirements

OBJECTIVES:

1) Provide leadership in the development and implementation of a national program to monitor US coral reef ecosystems.

2) Develop a "semi-coordinated" National network of monitoring sites,

3) Facilitate sharing of monitoring information among partners, and

4) Fill gaps in local monitoring coverage.

A coordinated coral reef ecosystem monitoring program provides a national assessment capability to track the status and trends of coral reef health, community structure, and condition of US coral reef ecosystems.

2002 National Coral Reef Ecosystem Monitoring Program

Program Partners

- Puerto Rico
- US Virgin Island
- Hawaii (main 8 and NWHI)
- Guam
- American Samoa
- Commonwealth of the Northern Mariana Islands
- State of Florida,
- Members of Freely Associated States

NOAA Complementary Monitoring and Assessment Studies

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Monitoring Themes

Benthic Parameters

- Cover (live, dead, etc.)
- Abundance
- Condition
- Size class distribution
- Indicator species
- Diversity*

Water Quality Parameters

- Nutrients
- Suspended solids
- Chlorophyll
- Turbidity
- Temperature
- PAR

Fishery Parameters

- Abundance & distribution
- Size class distribution
- Indicator species
- Diversity*
- Richness
- Evenness

EXAMPLES

NOAA NOS Biogeography Program Field Activities

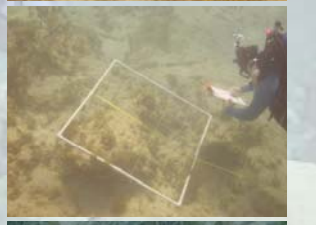
Baseline Characterizations of Coral Reefs and Associated Biological Communities around St. John, St. Croix, Southwestern Puerto Rico, and Hawaii

simultaneous collections

Fish Data Collected
- Abundance and Distribution
- Size Structure
- Trophic Dynamics (Gut Content Analysis)
- Habitat Utilization Patterns
- Community Structure (Diversity, Richness, etc.)

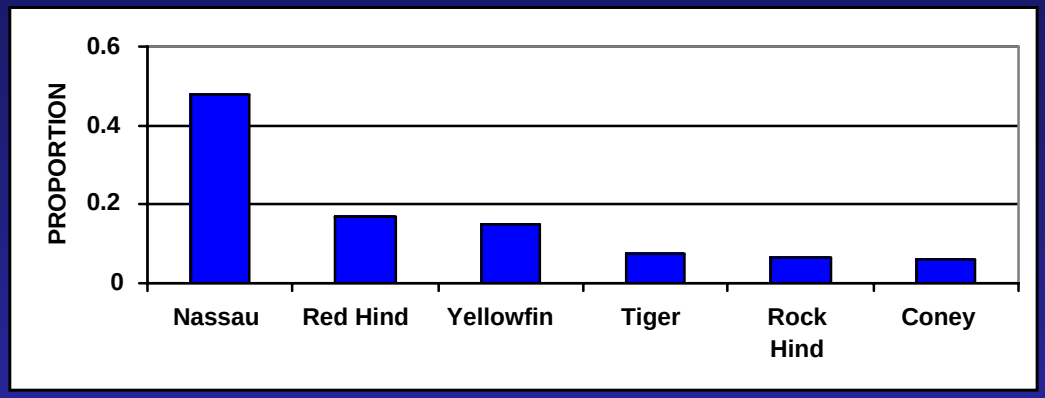
Fine-scale Habitat Characterization Data
- Coral Cover and Taxonomy
- Algal Cover and Taxonomy
- Seagrass Cover and Taxonomy
- Physiography
- Disease

Water Quality Data
- Temperature
- Salinity
- Turbidity
- Dissolved Oxygen
- Nitrates

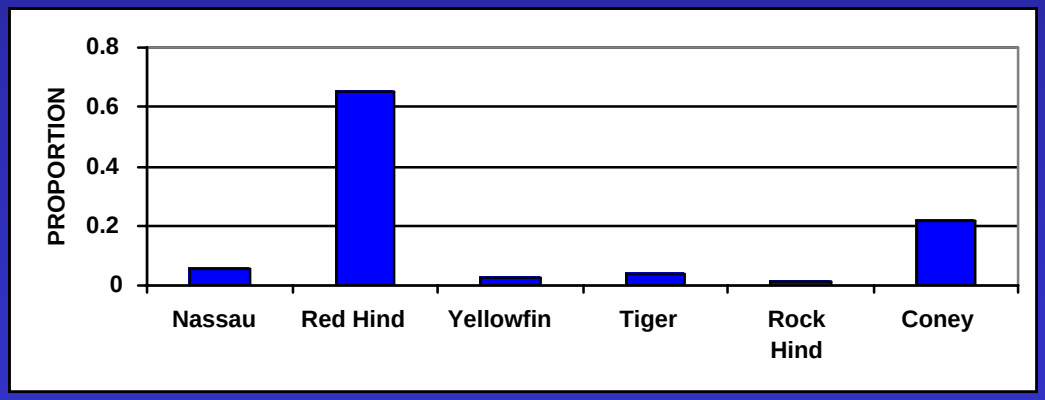


Historical Data Analyses

Abundance Comparisons

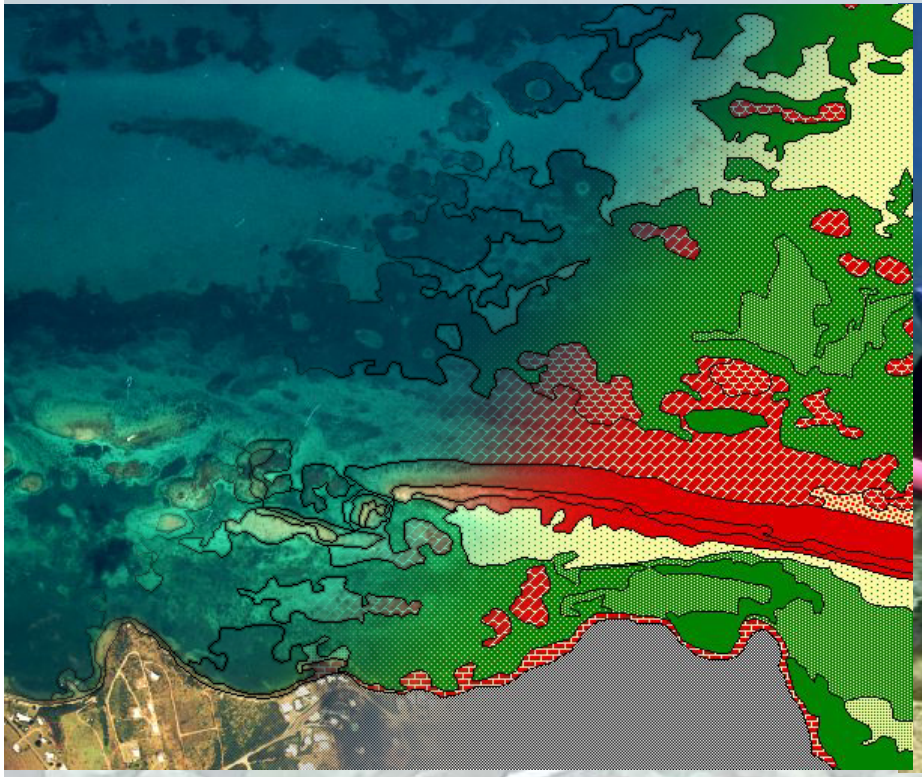


Comparison of the relative abundance of groupers collected by Randall, 1958-1961 around St. John, US Virgin Islands.



Comparison of the relative abundance of groupers observed by J. Beets, 1989-2000 around St. John, US Virgin Islands.

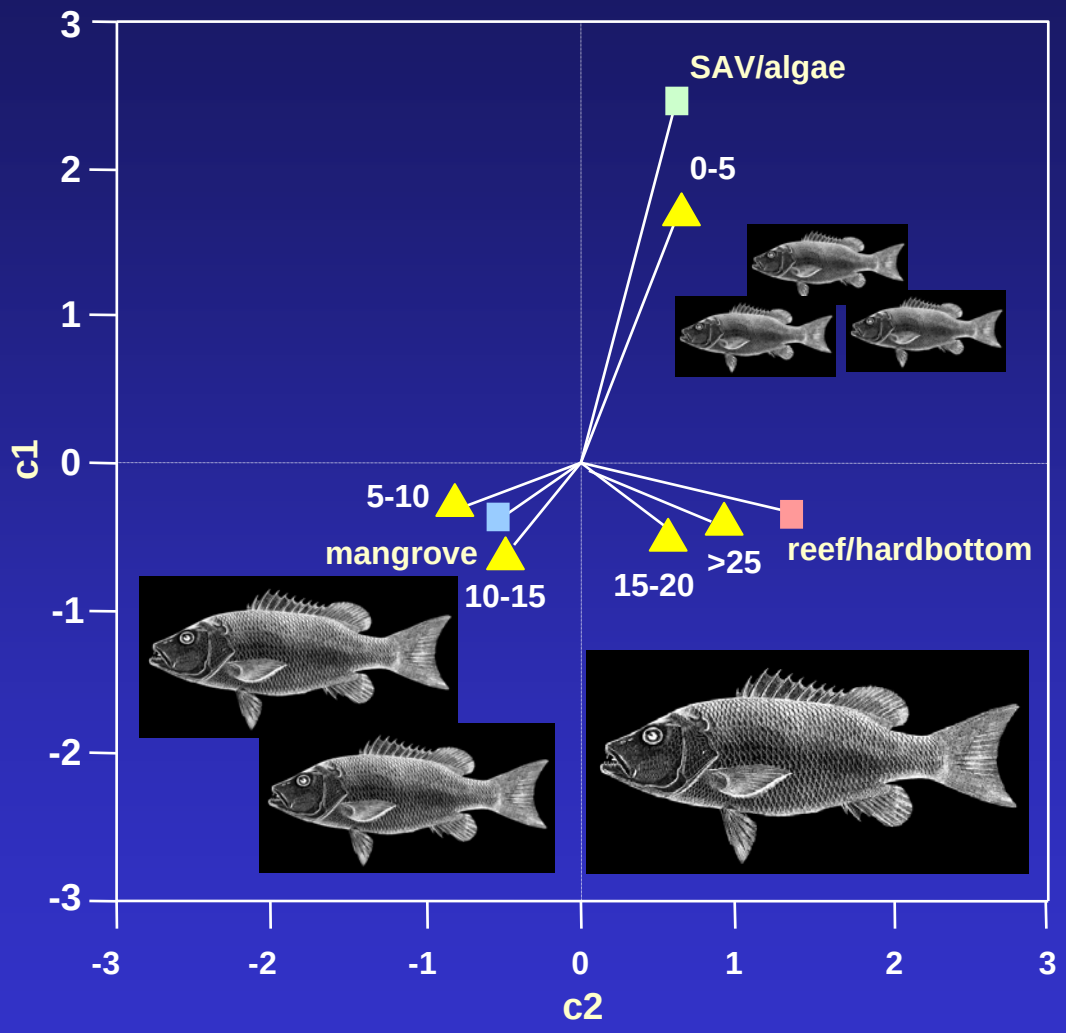
Integration of Mapping, Monitoring & Assessments



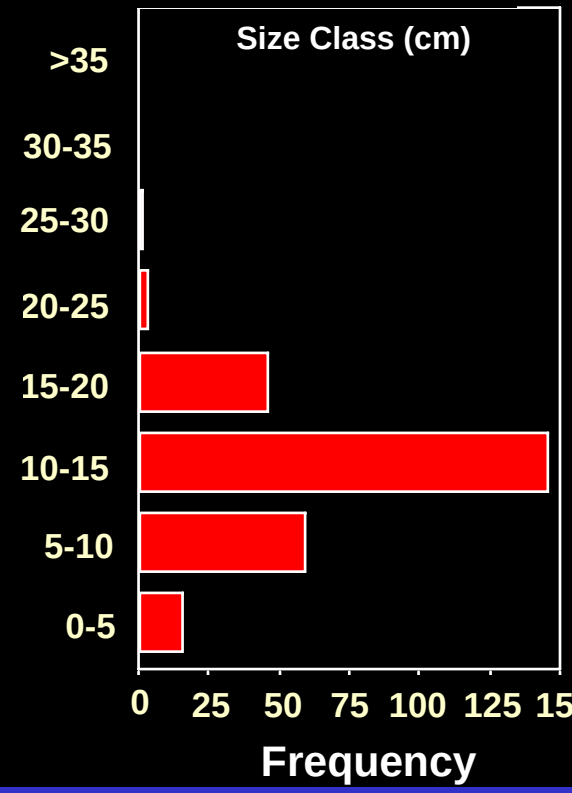
Habitat maps

Divers collecting benthic habitat, fish size, and abundance data along a transect.

Gray Snapper Habitat Utilization

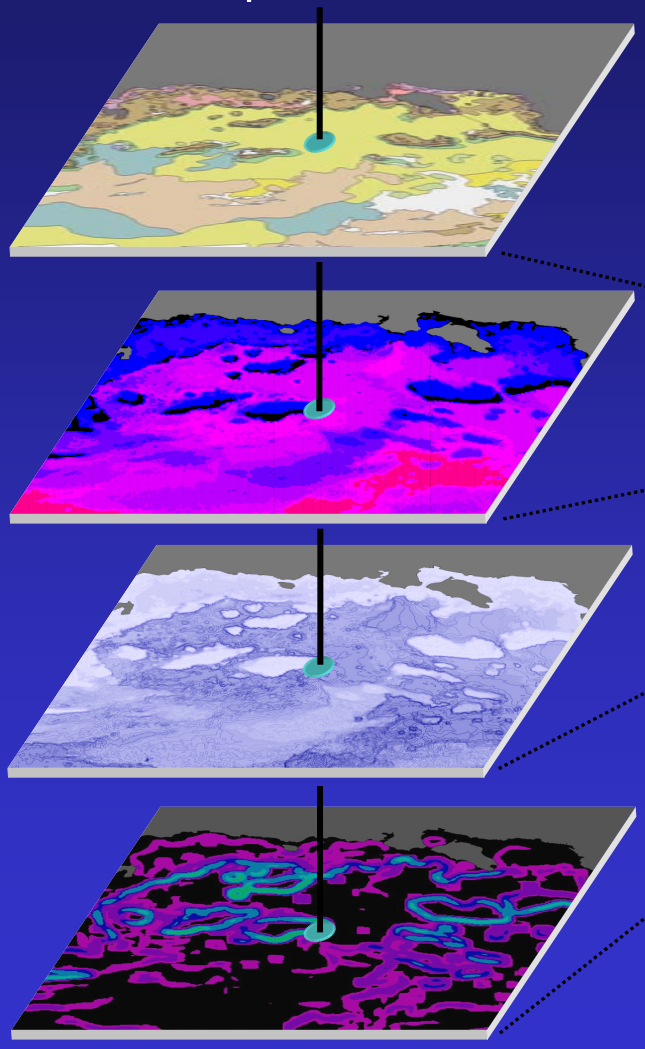


In this example, smaller snappers (0-5cm size class) were observed to select for submerged vegetation, while intermediate sized fishes (5-15cm) selected for mangrove habitats, and the largest size classes (15+ cm) selected for reef structure.



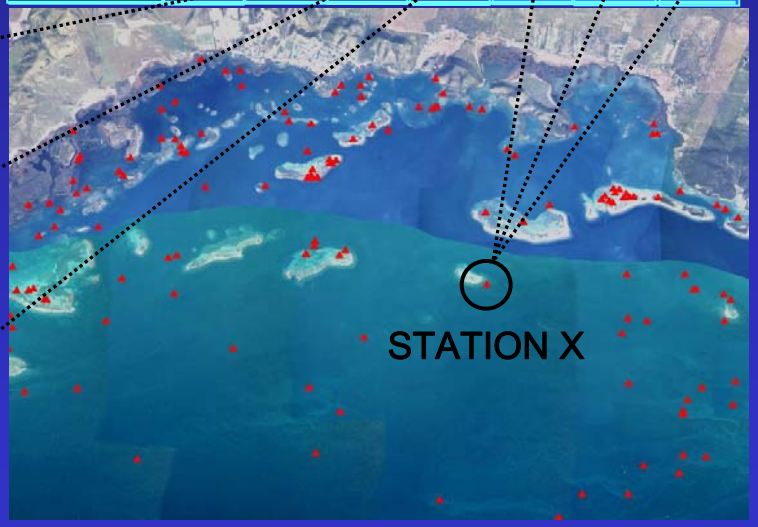
Assessment from Puerto Rico Monitoring

Drill Through Spatial Layers
Example: STATION X



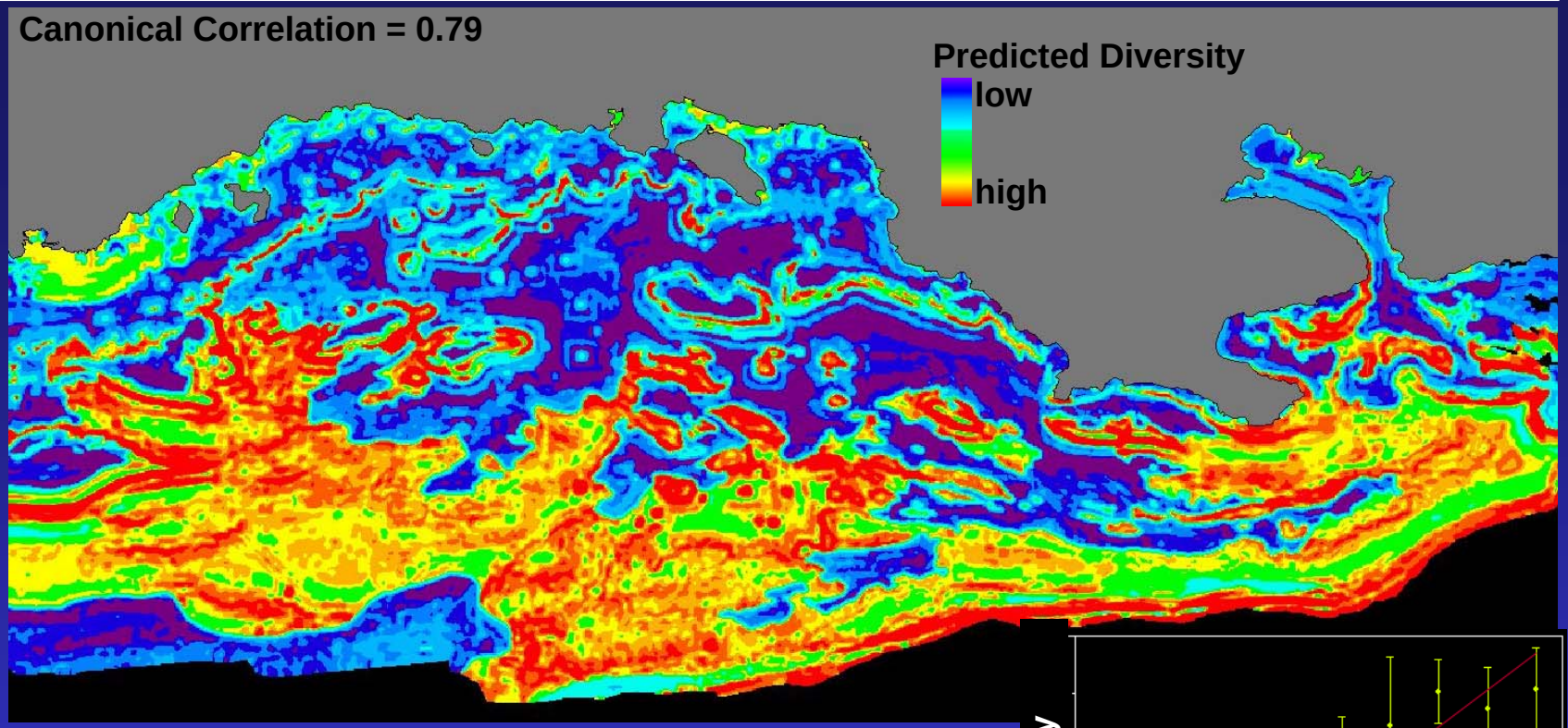
CREATING THE ANALYSIS MATRIX

STATION	HABITAT	HAB VARIANCE	DEPTH	DEPTH VARIANCE	RICHNESS	DIVERSITY	ABUNDANCE



This is Done for the Following Variance Resolutions:
60,100, 200, 300, 500, 1000 m
Base Resolution for all Grids is 20 meters

Results: Southwestern Puerto Rico

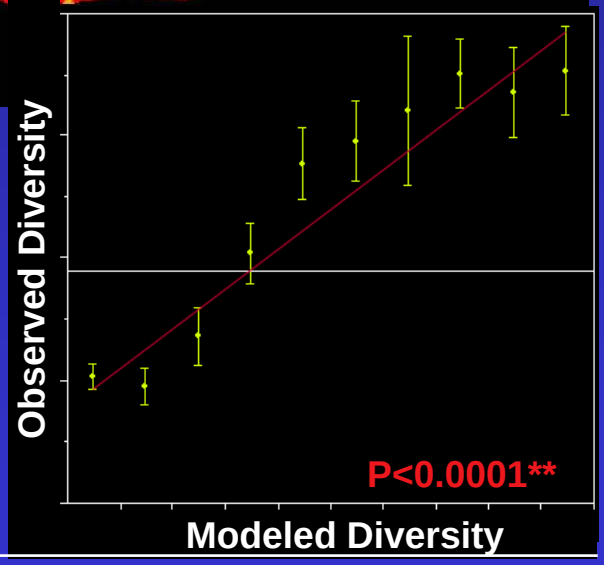


This map represents the canonical solution between landscape-level physiographic and fish community structure data.

MAP ACCURACY

OVERALL

0.77



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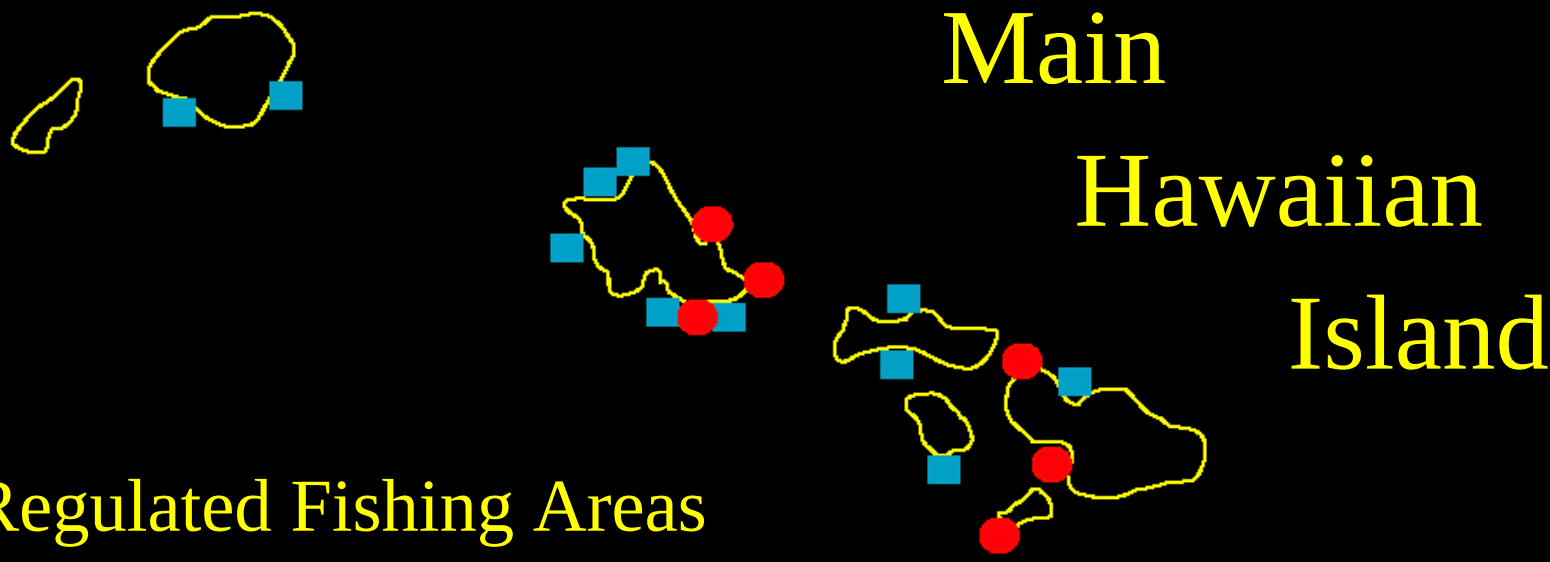
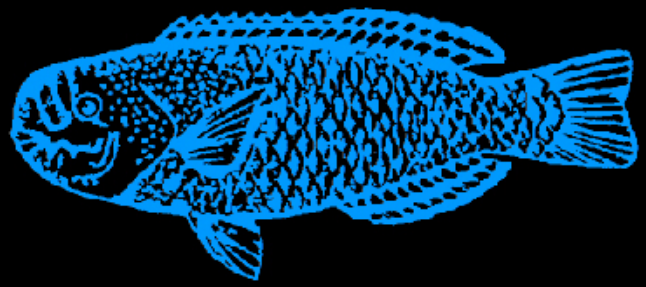
Main Hawaiian Islands



Regulated Fishing Areas

- No fishing area
- Fishing activities restricted



West Maui Study Area

Honolua/Mokulei MLCD

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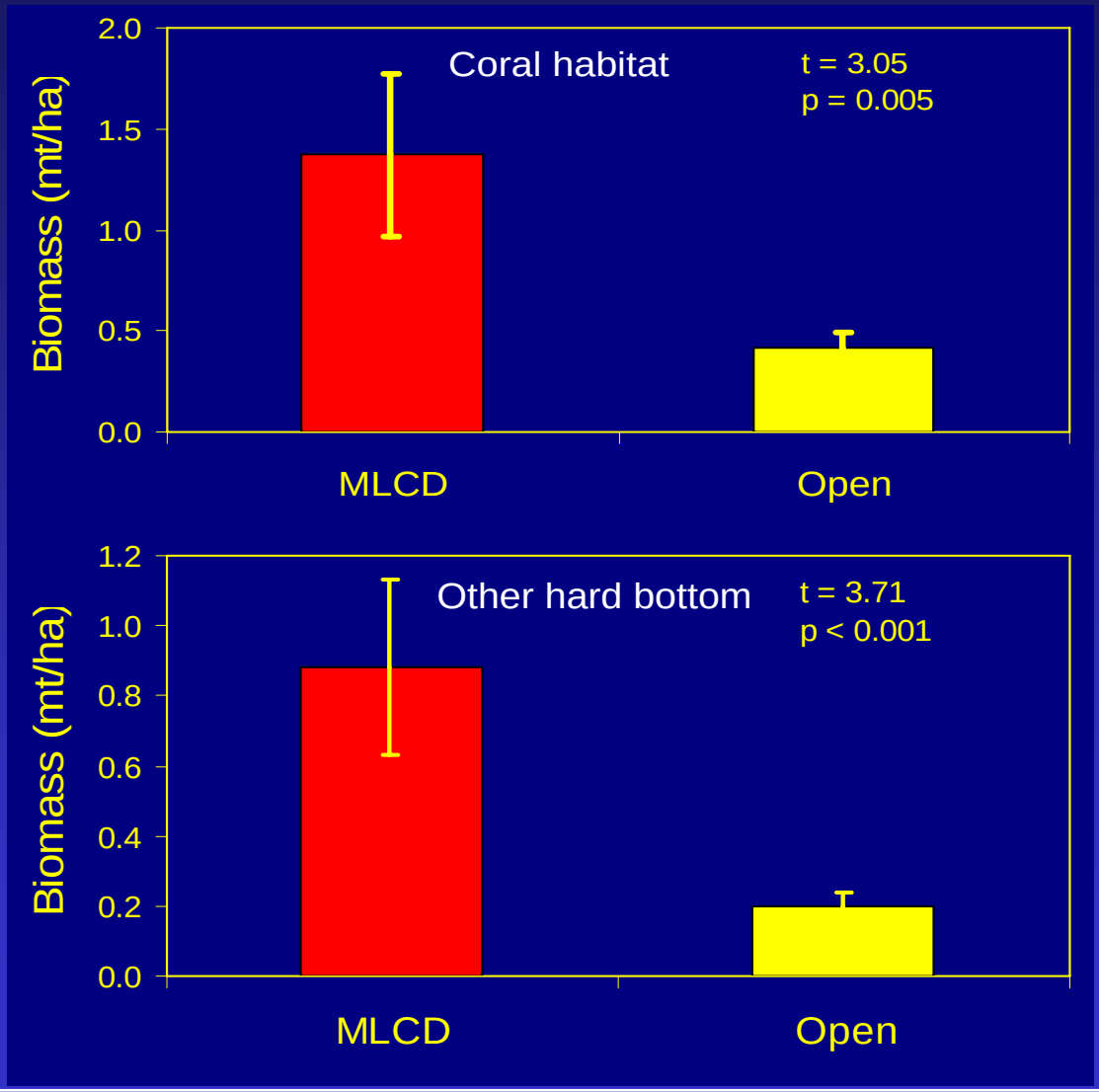
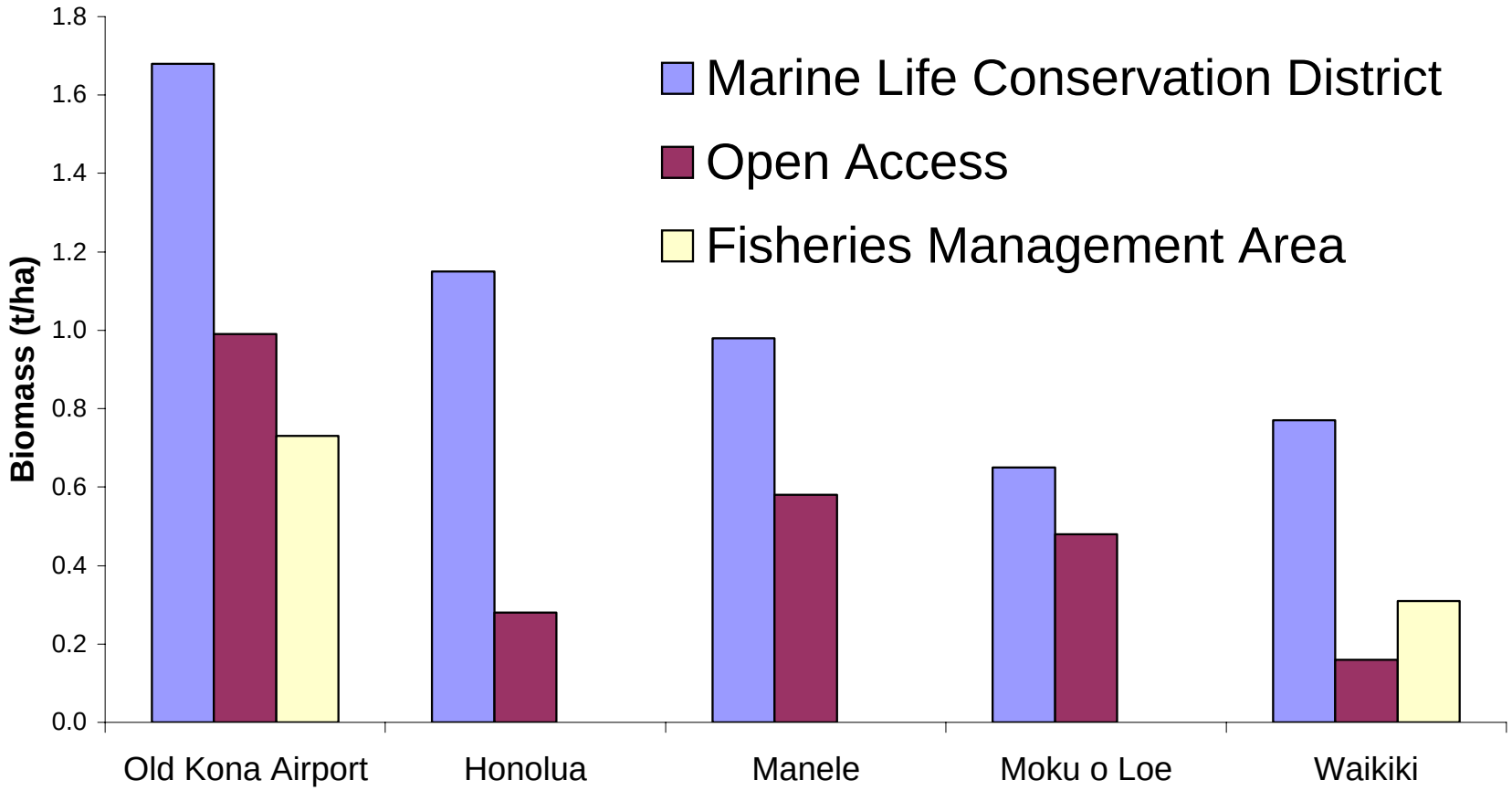
Comparison of Fish Biomass between Honolua-Mokule'ia MLCD and Areas Open to Fishing



Comparison of Fish Biomass in MPAs and Areas Open to Fishing in Hawaii (hard bottom habitats)



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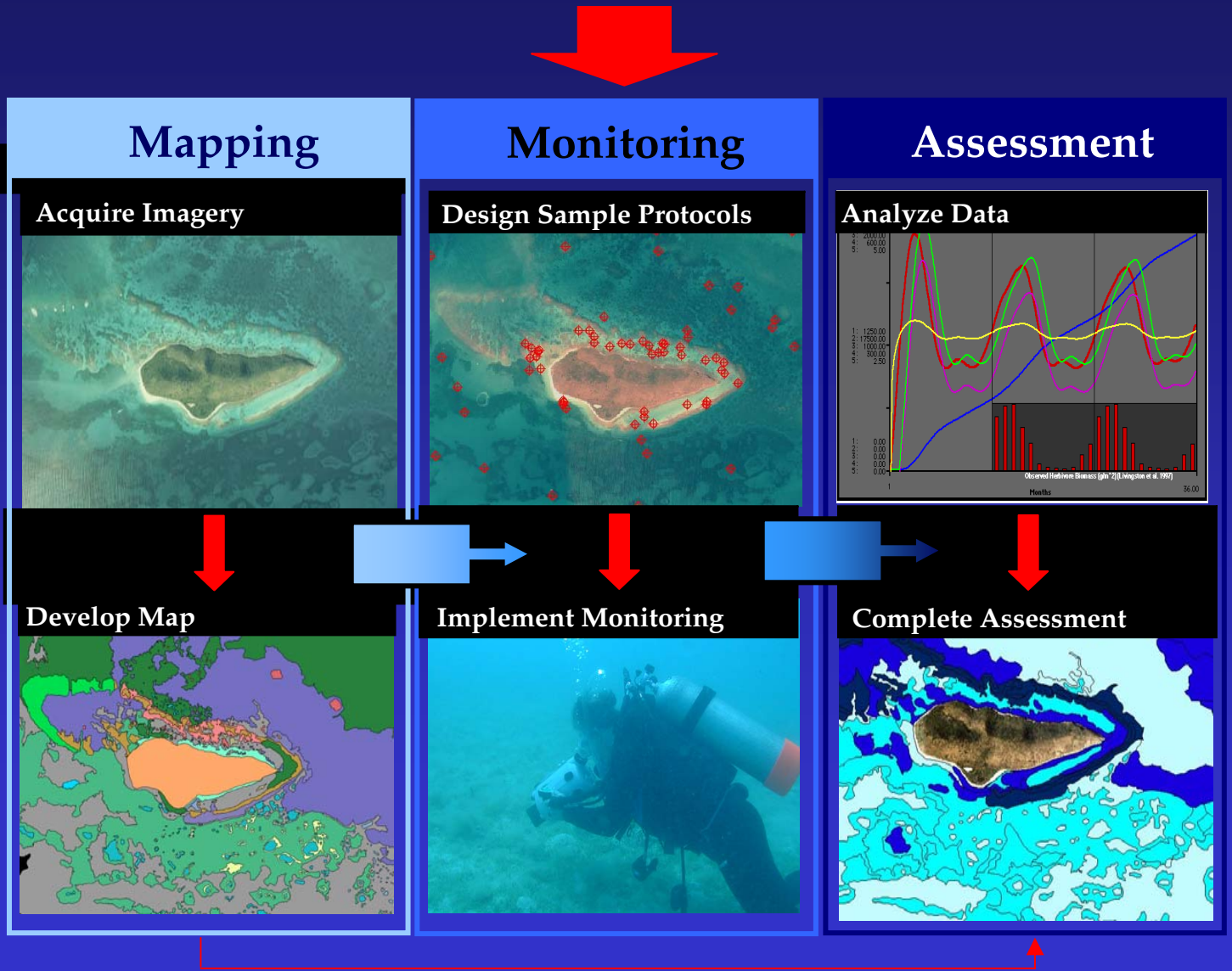
National Coral Reef Ecosystem Assessment Process



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